NAVAL POSTGRADUATE SCHOOL
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THESIS

AUTONOMIC LOGISTICS CAPABILITY OF THE
ADVANCED AMPHIBIOUS ASSAULT VEHICLE

by

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December 2000

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Paul G. Mack
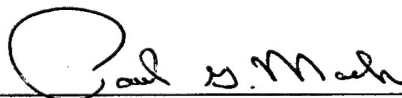Major, United States Marine Corps
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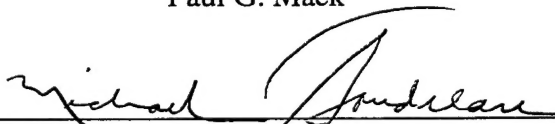
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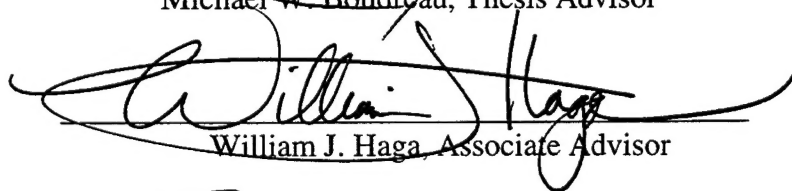## NAVAL POSTGRADUATE SCHOOL
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ABSTRACT

This study examined the feasibility of using on-board sensory data from the Marine Corps Advanced Amphibious Assault Vehicle (AAAV) as inputs to the Marine Corps Asset Tracking Logistics and Supply System, version II+ (ATLASS II+) as a way to improve sustained logistics decision making. It also looks at the possibility of feeding AAAV sensory data to the Optimized Naval Aviation Logistics Command Information System (NALCOMIS) at the Organizational Maintenance Activity (OMA) level. The major finding is that ATLASS II+ cannot fully support AAAV inputs at this time but the logistics system will be capable of such support when the AAAV is fielded in 2006. Another finding is that the Platform Software Interface Subsystem being developed for NALCOMIS could significantly improve the logistical management of the AAAV life-cycle if integrated into ATLASS II+. An additional improvement would result if the Configuration Management Subsystem of NALCOMIS could be integrated into ATLASS II+. Recommendations are made for logistical management practices and logistics policy.

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LIST OF ACRONYMS

AAAV	Advanced Amphibious Assault Vehicle
ACE	Aviation Combat Element
ADT	Administrative Delay Time
AIS	Automated Information System
AIT	Automated Identification Technology
AL	Autonomic Logistics
ALSS	Aviation Life Support System
ATLASS	Asset Tracking Logistics and Supply System
CE	Command Element
CSSE	Combat Service Support Element
COE	Common Operating Environment
DII	Defense Information Infrastructure
ELAS	Embedded Logistics and Administrative System
EOTC	Equipment Operator Time Code
GCE	Ground Combat Element
GCSS	Global Combat Support System
GUI	Graphical User Interface
HMMWV	High Mobility Multi-Purpose Wheeled Vehicle
IBIT	Interactive Built-in Test
IETM	Integrated Electronic Technical Manual
IMA	Intermediate Maintenance Activity
IMR	Individual Master Roster

JCALS	Joint Computer-Aided Acquisition and Logistics Support
JON	Job Order Number
LAN	Local Area Network
LLC	Life Limited Component
LRU	Line Replaceable Unit
MAGTF	Marine Air-Ground Task Force
MDT	Maintenance Downtime
MIMMS	Marine Corps Integrated Maintenance Management System
MIS	Management Information System
MME	Mission Mounted Equipment
MTBF	Mean Time Between Failure
MTTR	Mean Time To Repair
NALCOMIS	Naval Aviation Logistics Command Information System
NBIT	Non-Interactive Built-In Test
NIIN	National Item Identification Number
NTCSS	Naval Tactical Command Support System
OMA	Organizational Maintenance Activity
PEB	Pre-Expended Bin
POL	Petroleum, Oils, Lubricants
RCT	Repair Cycle Time
SASSY	Supported Activity Supply System
SBIT	Self-test Built-in Test
SCIR	Subsystem Capability and Impact Reporting
SE	Support Equipment
TAFIM	Technical Architecture for Information Management

TAMCN	Table of Authorized Material Control Number
TE	Table of Equipment
TEC	Type Equipment Code
TMDE	Test, Measurement and Diagnostic Equipment
TOC	Total Ownership Cost
WAN	Wide Area Network

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I. INTRODUCTION

A. PURPOSE

The Marine Corps is currently facing a problem in developing the Advanced Amphibious Assault Vehicle (AAAV). The challenge for the Marine Corps lies in the ability to take the data inputs of the AAAV and feed them into a supply and maintenance management system that will effectively utilize the information. The AAAV possesses an autonomic logistics (AL) capability that provides real-time and near-real-time access to performance and consumption data. This capability presents many opportunities and challenges to the Marine Corps. Operators, logisticians and life-cycle managers have never before had access to this information nor have they had an automated supply and maintenance system that would take similar inputs and effectively manage them.

This thesis suggests methods to improve the capability for Asset Tracking Logistics and Supply System Phase II+ (ATLASS II+) to effectively manage the AAAV inputs by a combination of improving its own capabilities and borrowing from Optimized Naval Aviation Logistics Command Information System (NALCOMIS) at the Organizational Maintenance Activity (OMA). ATLASS II+ is a recently fielded automated supply and maintenance system which manages ground equipment for the Marine Corps while Optimized NALCOMIS OMA manages Naval Aviation equipment. This thesis considers what inputs the AAAV can provide to an automated supply and maintenance management system and continues with a description of the current and future capabilities of ATLASS II+ and Optimized NALCOMIS OMA. A functional

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capability analysis between AAAV inputs and system capabilities highlights distinct gaps.

My analysis suggests that if the problem facing the AAAV and the Marine Corps is not solved, the AAAV operators, logisticians and life-cycle managers will not have accurate and timely supply and maintenance information. This information is critical to the situational awareness of operational readiness and the ability of our logistics system to support the AAAV. These deficiencies if not solved will degrade the ability of the Marine Corps to fight and win in future conflicts.

Instrumental to executing sea-based amphibious war-fighting concepts is a new generation of equipment that will deliver Marines and their equipment from ship-to-shore in a more rapid and less vulnerable way. This equipment of which the AAAV is the spearhead, provides onboard logistics capabilities to sustain Marines while operating from a sea-base. The AAAV is designed with an AL capability that provides real time and near-real time access to performance data viewable from any operational or logistics support level. This information will enable the operational commander and logistician to anticipate component or system failure. At higher levels of command and support, the same information may be used to make the supply chain more efficient and responsive by eliminating uncertainty and variability.

A Marine Corps wide study conducted by the Center for Naval Analyses (July 1998) of high mobility multi-purpose wheeled vehicles (HMMWV's) using information from legacy supply (SASSY) and maintenance management systems (MIMMS) concluded these systems do not "contain information that would allow for the determination of operational failure rates for class IX repair parts." It also concluded,

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there is no accurate way to assess and forecast the operational failure rates of ground weapon systems.

The Marine Corps began fielding an automated ground supply and maintenance management system in 1999 called Asset Tracking Logistics and Supply System (ATLASS II+). ATLASS II+ is a PC-based system that is replacing those legacy systems (MIMMS and SASSY). These latter two systems were fielded in the 1970s and based on mainframe technology of that era. ATLASS II+ was designed to improve on logistics information flow throughout all levels of command, improve accuracy and timeliness of information, improve visibility of assets, and reduce manual processing and redundant input of logistics information.

Naval Aviation utilizes an automated supply and logistics information technology. NALCOMIS uses maintenance information from rotary and fixed-wing aircraft to provide logistics information throughout all levels of command.

B.   RESEARCH QUESTIONS

1.   Primary Research Question

Do current and projected Marine Corps automated supply and maintenance systems have the capability to support the autonomic logistics inputs of the AAAV?

2.   Secondary Research Questions

- What autonomic logistics capability inputs can the AAAV provide?
- Can Asset Tracking Logistics and Supply System (ATLASS II+) support the autonomic logistics inputs from the AAAV?
- Can Optimized Naval Aviation Logistics Command Information System (NALCOMIS) at the Organizational Maintenance Activity (OMA) level support the autonomic logistics inputs from the AAAV?
- What advantages and disadvantages exist for ATLASS II+/Optimized NALCOMIS OMA to support the autonomic logistics inputs from the AAAV?

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- What does ATLASS II+ need to do to manage the autonomic logistics inputs from the AAAV?

II. AUTONOMIC LOGISTICS CAPABILITY OF THE AAAV

A. PURPOSE

The purpose of this chapter is to provide an overview of the autonomic logistics capability inputs to a predictive readiness system from the Advanced Amphibious Assault Vehicle (AAAV).

B. BACKGROUND

The principal ground equipment acquisition to enable the Marine Corps to execute future operational concepts such as Joint Vision 2020, Operational Maneuver From the Sea, and Sea-based Logistics is the AAAV. Characteristic of these future operational concepts is the application of information and systems integration technologies that provide decision makers with accurate and timely information from the battlefield. "This information technology will improve the ability to see, prioritize, assign and assess information. [Ref. 1]

Future operational concepts and the need to actively evolve our logistics efforts to support them is the principal rationale behind the need for the AAAV to possess the autonomic logistics capability. Autonomic logistics describes the capability to automatically generate and transmit real-time and near real-time system performance data from a weapon system such as the AAAV to remote stations for processing. [Ref. 2:p. 1]

The Marine Corps has also looked to the private sector by adopting their best practices to improve our logistics processes. What we have discovered is the private sector has evolved in the way they view equipment readiness.

The maxim that maintenance is about preserving physical assets no longer exists. The private sector views maintenance as preserving the "functions" of assets. [Ref. 3] In the past, the private sector used equipment until it failed. This repair-after-failure philosophy became known as corrective maintenance. Engineers then formulated a method to perform maintenance at prescribed, statistically based intervals regardless of equipment condition. This method became known as preventive maintenance.

Although a valuable maintenance strategy, preventive maintenance incurs unnecessary costs. These costs are in the form of labor and parts replacement. Labor rates for mechanics are high, and using them to conduct maintenance on equipment that is functioning properly is wasteful. Replacing parts over periodic intervals regardless of their condition is also costly. Reliability of parts today is better than in the past. Replacing parts that still have useful service life with brand new parts is also wasteful.

The private sector no longer views preventive maintenance as about preventing failures but rather it is about avoiding, reducing, or eliminating the consequences of failure. [Ref. 3] Predictive or condition-based maintenance uses the current operational status of equipment to predict the life expectancy of components and systems. [Ref. 4]

A predictive readiness system takes information that accurately reflects vehicle usage, trends, performance monitoring, historical and embedded sensor electronic data to measure and analyze equipment-operating parameters in order to prevent unscheduled downtime of equipment. [Ref. 5:p. 5-14]

Four factors facilitated the move to predictive or condition-based maintenance techniques: availability of technology that can be applied to more powerful and less

expensive computers, advances in sensor systems, improved algorithms for data acquisition, and advanced methods for signal processing. [Ref. 4]

The application of these technologies in design and development of the AAAV allows for real-time feedback on the operational status of designated systems and relates performance to mission profiles. [Ref. 4] The data collected also are able to indicate the performance status of other components within the system. Use of this technology and its applications will result in the AAAV meeting three objectives: 1) to increase operational availability, 2) reduce total ownership costs (TOC) and 3) to improve operator and equipment safety. [Ref. 6]

C.   SYSTEM DESCRIPTION

1.   Sensors

AAAV sensors are embedded throughout the vehicle to monitor the performance of elements within the turret and the vehicle hull. Components within the turret or hull were selected to be monitored by meeting one or more of the following criteria: 1) mission critical, 2) maintenance cost-driver, 3) reasonable lead-time to failure. [Ref. 7] Performance monitoring is conducted through the application of sensor technology for oil analysis, vibration analysis, engine analysis and thermography.

Oil analysis sensors evaluate the condition of the vehicle by taking into account oil chemistry, mechanical wear and contamination. Oil chemistry is concerned with the viscosity of the lubricant. If the oil is breaking down, it does not effectively lubricate components. Contaminants in the oil such as metal particles or water can indicate excessive wear or lead to oxidation.

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Vibration analysis sensors monitor the forces that act on a component internally or externally. These forces cause the component to vibrate, thereby reducing component life. The vibrations are measured by accelerometers. Impending equipment failures can be determined if vibrations exceed limits.

Engine sensors monitor electrical faults, providing data that can be collected and analyzed for trends. These data illustrate electrical problems as they occur.

Thermography sensors detect variations in heat emitted by objects. They identify electrical problems, friction-induced heating and process problems due to heat.

Turret sensors monitor ammunition quantities and overall health of the turret that includes the number of rounds fired through the system (weapon firing data), weapon system status (up/down), and fire control system status.

Hull sensors monitor aspects of vehicle mobility. Besides monitoring POL levels, these sensors monitor engine, power transfer module, and propulsor (See Figure 2.1). Sensors on the engine monitor oil condition and determine whether there is debris in the oil. Engine sensors also monitor cylinder firing pressure and engine torque. The power transfer module monitors gear mesh/bearing vibration as well as oil debris and condition. The propulsor sensors monitor forward bearing vibration, bearing temperature and foreign object damage blade imbalance.

2.   System Health Computer

The raw electronic inputs from the hull and turret sensors are digitally converted by the respective system health computers. The turret system health computer takes direct sensor information such as number of rounds fired through the weapon(s) and converts it into something the turret electronics unit can understand.

Likewise, raw electronics inputs from the hull sensors, e.g. POL usage, accelerometer data, and engine analysis trend data are passed to the hull electronics unit (See Figure 2.1).
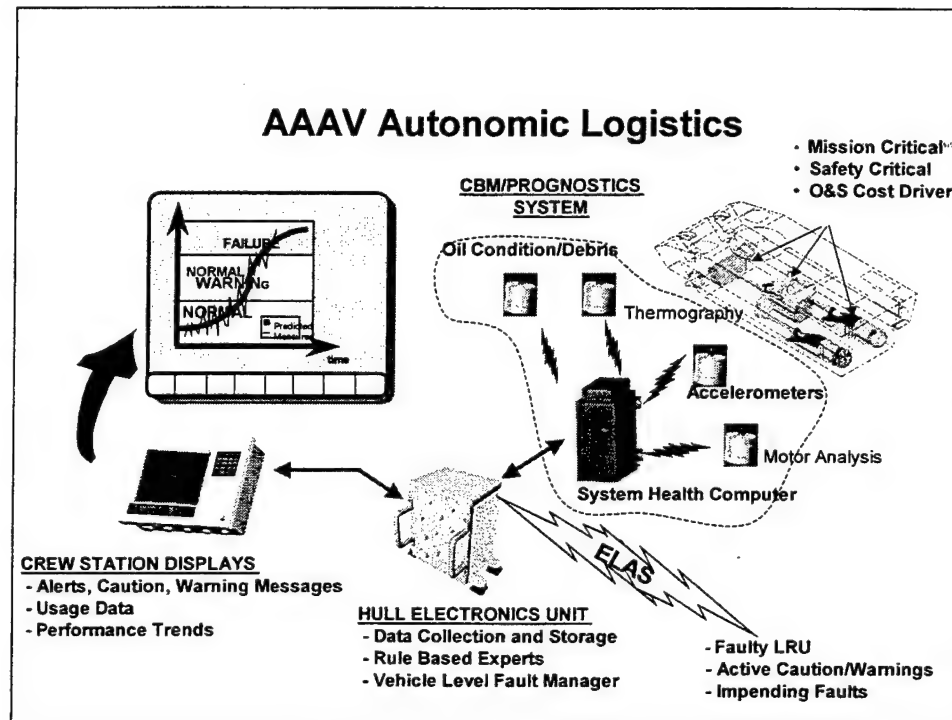
Figure 2.1.   AAAV Autonomic Logistics System. After [Ref. 7]

3.   Electronics Unit

As the data from the sensors are collected, the respective electronics unit (See Figure 2.1) uses rule-based expert system algorithms to convert the data into information on subsystem health. This subsystem health is managed through the electronics unit vehicle level fault manager. The manager monitors subsystem health and when components reach out-of-tolerance levels, the crew is alerted through a station display.

4.   Crew Station Displays

The crew station displays (See Figure 2.1) receive initial input from the vehicle level fault manager in the form of alerts, cautions, and warning messages. The

crewmembers can now take the information from their displays to troubleshoot the problem. On the AAAV, troubleshooting is conducted by the crewmembers using such on-vehicle tools as the integrated electronic technical manual (IETM) with advanced diagnostics algorithms that isolate the fault(s) and describe(s) the necessary repair action.

5. Integrated Electronic Repair Manual (IETM)

The IETM is a completely interactive repair manual that can be accessed through the crew station displays. The IETM guides the mechanic from identifying the problem, to fault isolation, to specific maintenance instructions, followed by identification of the part(s) to order. IETMs function as an operator guide, vehicle logbook, and diagnostics/prognostics tool.

6. Diagnostics

The AAAV diagnostics capability can be categorized into three areas: (1) real-time operator notification of failures or problems, (2) operator interaction to locate and isolate failures and (3) operator ability to identify potential failures prior to occurring. [Ref. 8] The SBIT (self-test built in test); IBIT (interactive built in test); and NBIT (non-interactive built in test) capabilities provide the user/maintainer with indication of system status, fault detection, and fault isolation down to the replaceable component. This capability is designed to identify 95% of all internal mission critical failures, which would not otherwise be readily evident to the operator, with a 90% confidence level. [Ref. 9]

7. Prognostics

AAAV sensor-based prognostics capability is designed to logically predict critical mission failures down to the line replaceable unit (LRU). LRU is defined by the Defense Acquisition Desk book as an essential support item removed and replaced at field level to

restore an end item to an operationally ready condition. The AAAV uses its onboard computers, data busses and crew station display panels to report and store historical vehicle status. The prognostics system uses this data for trend analysis in order to predict failure conditions for the selected mission critical subsystems. The prognostics verify operational status of the subsystem, monitors for fault conditions and isolates predictable failures down to the LRU level. [Ref. 10] The onboard prognostics will indicate 50% remaining life, 25% remaining life, 10% remaining life, 5% remaining life, and "Imminent Failure" on the crew station displays. [Ref. 8]

If the crew cannot repair based on lack of a part, they can order the correct part through the system automatically via the Embedded Logistics and Administrative System (ELAS). The part(s) and its associated national stock number(s) are ordered correctly the first time without filling out orders manually. If the part is on hand at an alternate geographic location, the owning unit or Combat Service Support element will have visibility of the supply transaction and may schedule the maintenance. The maintenance team either on the ship or some other geographic location will be able to remotely access the information to diagnose and schedule the repair. The depot or contractor will also have visibility of this supply transaction.

8. Embedded Logistics and Administrative System (ELAS)

The key component for collecting, storing, and managing the autonomic logistics inputs (to a predictive readiness system) is the Embedded Logistics and Administrative System (ELAS). ELAS is an interactive database. This database serves several functions. It collects historical data from vehicle subsystems such as engine hours, vehicle miles, component failures; it replaces the paper version of the vehicle logbooks; it

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supports data entry and management of vehicle inventory, and also serves to support data entry for pre-embark vehicle personnel manifests. [Ref. 11:p. 15-16] Additionally, ELAS serves to capture data elements from the operational picture that include ammunition and fuel load status. The information that ELAS stores and manages is automatically transmitted off the vehicle and serves as input to feed a remote predictive readiness system. See Appendix A for a listing of autonomic logistics inputs from the AAAV. ELAS interfaces with several built-in technology applications that include smart sensors, diagnostics, prognostics, integrated electronic technical manuals (IETM), and information management systems. Together they monitor component health, collect and store performance data, interpret the data, and provide feedback that commanders, combat service support personnel, and life-cycle management personnel/systems may utilize.

III. ASSET TRACKING LOGISTICS AND SUPPLY SYSTEM (ATLASS) PHASE II+

A. BACKGROUND

ATLASS II+ is a network-based system that integrates ground supply, maintenance management, and material readiness functions into one automated logistics information system for the Marine Corps. Prior to ATLASS II+, the principal automated logistics information systems in the Marine Corps were ATLASS PHASE I, Supported Activity Supply System (SASSY), and Marine Corps Integrated Maintenance Management System (MIMMS).

MIMMS and SASSY were initially fielded in the late 1970's and based on 1960's era technology. MIMMS processed all ground maintenance activities. SASSY was responsible for records tracking, and processing pertaining to supply asset disposition. They were designed to support commanders and logistics managers at all command levels in the execution of ground equipment maintenance management as well as supply functions. [Ref. 12] Both MIMMS and SASSY consisted of distinct mainframe computers that were used to process data on respective maintenance and supply operations. Each was also supported by a parallel personal computer (PC) based application in order to collect data.

Although a vast improvement over the previous methods of manual transcription and recording, MIMMS and SASSY still contained inherent deficiencies. [Ref. 13] The greatest deficiency in both systems was the labor-intensive nature of collecting and imputing data. Additionally, minimal data entry point validation and the frequency of

redundant data entry often led to erroneous data input. Batch cycle processing in the mainframes led to delays for several days and often up to several weeks in identifying and correcting input errors. [Ref. 13:p. 10] Also, transfer of information between the two distinct systems was limited to the mainframe level.

Further improvements in automated information systems (AIS) technology occurred in the 1980's. For the Marine Corps, this technology application occurred primarily in supply information processing. This led to the ability to process supply information while deployed and the capability to communicate with other Marine Corps AIS systems. As technology matured so did the ability to field a mainframe capability into a pc-based application.

ATLASS I was fielded in 1994. It incorporated the best functions of previous generations of AIS, to include SASSY onto a pc-based application. Although ATLASS I did not replace MIMMS/SASSY, it did allow for the transfer of maintenance information into SASSY loaded pc's. This allowed maintenance transactions to be processed in ATLASS so that proper SASSY requisitions could occur and parts issued. Associating this information to a specific maintenance record still had to be accomplished separately in MIMMS. Although information exchange improvements were made over MIMMS and SASSY by fielding ATLASS, deficiencies still remained. The greatest challenges lay in asset tracking and operational readiness reporting.

Asset tracking challenges resulted from how the Marine Corps structurally organizes for battle and how the equipment asset records are established in SASSY. The Marine Corps organizes for battle along a Marine Air-Ground Task Force (MAGTF). The MAGTF is comprised of four elements: command element (CE), ground combat

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element (GCE), aviation combat element (ACE), and a combat service support element (CSSE). The Marine Corps is organized around the largest MAGTF, the Marine Expeditionary Force (MEF). The Marine Corps has three active duty MEF's. The MEF is comprised of a MEF headquarters (CE), a Marine Division (GCE), a Marine Aircaft Wing (ACE), and a Force Service Support Group (CSSE). A MEF numbers approximately fifty thousand Marines and their associated equipment. Not all missions require that size of a force, so in order to execute a mission, the Marine Corps task organizes and draws combat capabilities from each element within the MEF. A MAGTF depending on mission may range in size from a few Marines and several pieces of equipment all the way to the entire MEF. As a result, there may be several temporary MAGTF's of various sizes training and/or deployed simultaneously at any given time within a given MEF. Tracking assets within this operational framework can challenge the best logistics systems.

Determining who owns a piece of equipment and where that piece of equipment physically is located in order to maintain and supply parts is a major deficiency in ATLASS. Ownership and location is based on a series of data tables resident in SASSY pc's. [Ref. 12:p. 12] The challenge exists because the authority to modify the ownership and location reside at the highest organizational level. So, although an ownership change may be initiated in a pc at a low level, the change must be authorized and effected from the top, and at the mainframe level. Batch processing by MIMMS and SASSY as well as lack of interface between each systems pc's and mainframes contribute to additional challenges. Supply and maintenance records are not easily transportable from the owning organization to the temporary one. Lack of visibility of ownership will inhibit sending

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the right parts to the right place. Without the correct parts to fix equipment, readiness suffers.

Monitoring operational readiness of equipment presents another challenge that remained a deficiency under ATLASS. Operational readiness is determined by comparing the number of properly functioning assets with the total on-hand. This is easily accomplished in MIMMS loaded pc's and when the organization is sedentary. When equipment is deployed its status must be manually loaded in the readiness information databases under ATLASS. This is not only time consuming but inaccurate because the information again has to be batch processed at the mainframe level. This leads to an inaccurate picture of equipment status and therefore equipment readiness.

ATLASS II+ was designed to correct deficiencies that continued to plague ATLASS. By exploiting technology, ATLASS II+ corrected ATLASS faults and met additional design objectives [Ref. 13:pp. 13-14]:

- Be fully deployable, allowing identical operations while deployed and in garrison

- Be capable of operation on the same architecture as Naval Tactical Command Support System (NCTSS), in order to support shipboard operations and to take advantage of the connectivity available through ship networks

- Provide asset visibility and logistics posture to higher, adjacent, and supporting units, thus providing greater situational awareness on the battlefield

- Improve accuracy and timeliness of information

- Reduce manual processing and redundant input of logistics information through automated technology

Current ATLASS II+ system capabilities are highlighted in the following paragraphs. For a complete listing of current capabilities see Appendix B.

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B.   CURRENT SYSTEM CAPABILITIES

1.   Overview

Fielding and operational use of ATLASS II+ began in May of 1999 with Marine Corps units based in Camp Lejeune, North Carolina. This was followed in October 2000 to Camp Pendleton based units. Final fielding to operational forces will begin in April 2001 to units stationed in Okinawa Japan. ATLASS II+ operates at the organic and intermediate levels of Marine Corps ground supply and maintenance management. It provides the Marine Corps with near real time status of all supply, maintenance, and readiness functions through the utilization of a Sybase relational database that operates on a client-server environment. [Ref. 14] Functional capabilities include: tracking organizational inventories, preventive and corrective maintenance actions, equipment record jackets, requisitioning parts, receipt control, and calibrations. [Ref. 14]

The ATLASS system consists of five components (See Figure 3.1):

- Maintenance component
- Supply component
- Readiness component
- Reporting component
- System component

The Maintenance component is responsible for tracking and recording all maintenance-related information. This includes current work orders, material requirements and all historical data. The Supply component is used to requisition parts, report parts availability and track repairable and consumable inventories. The Supply component also provides near real-time status of parts requisitions. The Readiness component is a tool used to accurately reflect equipment status. This includes reportable items and non-reportable items. This component also tracks deadlined assets, excesses,

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shortages and will allow for general comments regarding material condition to be inputted. [Ref. 14] The Reporting component contains a number of predefined reports that may be generated to include supply inventory reports. There is an additional reporting capability to generate ad hoc reports. The System component performs administrative functions. It has the capability to control access, utilities, interface controls and database manipulation.

ELAS

AAAV AL INPUTS

ATLASS II+

- Historical Data
- IETM
- Operational Information
- Diagnostics
- Prognostics
- Vehicle Inventory
- Vehicle Logbook

- Maintenance Component
- Supply Component
- Readiness Component
- Reporting Component
- System Component
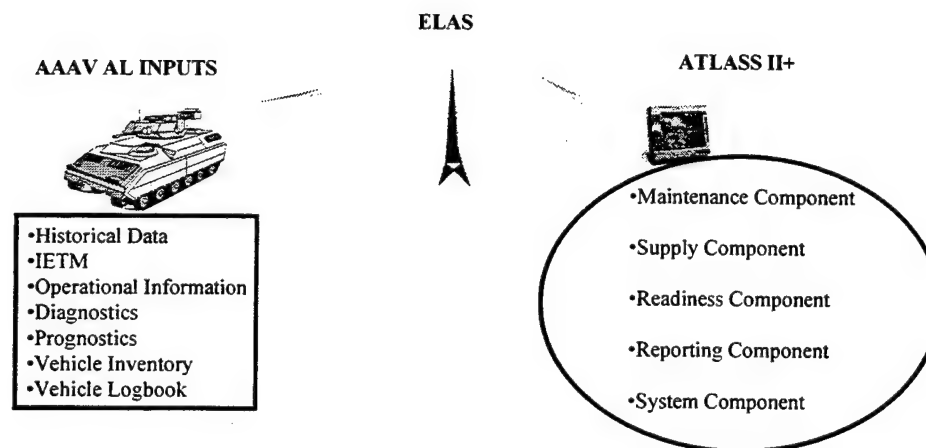
Figure 3.1   AAAV Data Stream into ATLASS II+.

2.   Maintenance Functions

The Maintenance component has the following functional capabilities: creates, lists, and updates work orders and tasks; requisitions parts; signs off on all maintenance and material requirements; and allows access to maintenance historical files. [Ref. 14]

In order to induct a piece of equipment into the maintenance cycle a work order and associated tasks are created in the maintenance component. A work order is initiated

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for a particular piece of equipment by one of three identifiers: Table of Authorized Material Control Number (TAMCN), serial number or National Item Identification Number (NIIN). Only one work order is opened at a time on any given piece of equipment but multiple tasks may be associated with it. As the tasks are fulfilled, they are closed. Only when all tasks are finished is the work order closed.

Parts requisitions occur when the work order is opened and tasks are associated with it. The system automatically checks the availability of parts. It begins with the owning unit's supply stocks, and if available will issue it. If the part is not available at the using unit, the parts request is automatically sent to the next level of supply support, until the requisition is filled. Parts can be ordered either in a package or individually in order to affect a specific repair such as a corrective maintenance action or to perform preventive maintenance. Requisitions are usually associated with the work orders but may not be in order to replenish pre-expended bins, shop-overhead items, and some other non-specific parts. The maintenance system has the capability to maintain visibility of the status of each task, who is working on it, and how long the item has been in the maintenance cycle. It also can track components and end items that have been evacuated to a higher echelon of repair, such as intermediate or depot level.

The maintenance history portion of the maintenance component provides for the viewing of up to twenty-seven months of active data. After twenty-seven months, the data are removed from active servers and archived. It allows for viewing by TAMCN, serial number, or NIIN and by type of maintenance. Types of maintenance include:

- Preventive
- Corrective
- Modifications

- Calibrations
- Components
- General work performed

Additional information collected and catalogued includes maintaining information on equipment that is in storage, to schedule preventive maintenance and calibration, to update meter readings and equipment operator time codes (EOTCs). Pre-expended bin (PEB) information such as locations and inventory lists are also managed. A mailbox feature is also used to notify maintenance personnel of work to be accomplished. It contains features such as: tasks pending approval, tasks appending acceptance, parts pending approval, evacuations appending approval, components pending approval, indirect parts pending approval, equipment awaiting pickup, and equipment nearing their return dates. [Ref. 15]

3. Supply Functions

The Supply component contains the following functional capabilities: requisitions parts; reports parts availability; maintains repairable, organic, and consumable inventories; and provides near real-time status response on parts/supplies requisitioned. [Ref. 14] It implements these functions through a number of features within the Supply component. These features include: requisitions, property accounting, storage, fiscal, management data, history, and the mailbox. [Ref. 15]

The requisitions feature provides users with detailed information on new, open procurement, and offline requisitions. Routine items, priority items, table of equipment, and no cost items may be ordered. The system automatically determines if there are sufficient funds in the appropriate budget to order the parts. If there is, the order requisition will process, if not, the system will respond with an insufficient funds error.

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A short funds requisition will then process. Once processed, the user can access an order and initiate supply actions to it. The user can modify the order, check on its status, and/or cancel it if necessary. Upon receipt, the supply component can process on hand receipts, receipt reversals, duplicate receipts, and receipts not due. These receipts are processed interactively, while receipts recorded by a remote entry device are processed in a batch-input procedure.

Property accounting is accomplished through a function which tracks the gains and losses of organic equipment, operating stocks, secondary repairables, garrison property, and individual issues. It also allows tracking of the transfer of equipment, temporary loans issued and received, and to update quantities of various allowances. These allowances include: special, war reserve, safety stock, initial issue provisioning, requisitioning objective, and re-order point.

The storage function tracks information on inventories, locations, and material asset tracking. Inventories may be scheduled based on who owns it, type of material, and frequency of inventory required by pertinent orders. Frequency of inventory consists of spot, cyclic, and random. Limits can be placed on the number of items to inventory by location, supply class, and identifier (TAMCN or NIIN). Inventory records are interactive with scanners that are used to expedite the process. Scanner conducted inventories then update the supply files showing losses or gains. Updated inventory reports can then be printed or electronically distributed.

Fiscal information is tracked via an additional feature within the Supply component. Fiscal authorizations, details, offline expenditures, and rollover of funds can be managed by fiscal year, quarter, and budget type. Budget authorizations can be

increased or decreased by work center, cost code, or job site. Offline expenditures can obligate funds expended for non-specific material or services. Funds can also be rolled over to the next accounting period as authorized.

Additional features within the Supply component include a data management function, history option, and a mailbox. The data management tool is utilized to modify NIIN, part numbers, and TAMCN. It can also be used to search for specific end items or part records. Historical records are collected for up to twenty-seven months. Requisitions by document number and property accounting records may be accessed and viewed. The mailbox feature affords the user to send messages regarding supply authority disposition over property accounting, requisitions, supply interface, stock control, and suspended records.

4. Readiness Functions

The Readiness functions tool accurately reflects all assets (reportable, non-reportable, dead-lined, table of equipment (TE) excesses and TE shortages). [Ref. 14] Access is limited to view only; however, there is a function that allows the user to make remarks regarding the status of each item of equipment.

5. Reports Function

The Reports component of ATLASS II+ allows users to request a number of predefined reports, including supply inventory reports. The supply reports available are money value gain/loss, inventory worksheet, and inventory location verification. [Ref. 15] It also provides an ad hoc reporting capability where users can extract elements of information to fulfill their reporting requirements.

6. Systems Function

The Systems component controls security, administration of system tables, interface capabilities, and system utilities. It also allows administrators to review requests for reports and release them for distribution. [Ref. 14] The security option is used to establish users and control screen access. Administrative database management is accomplished by viewing and reconciling inventory data, archiving completed and cancelled requisitions, and viewing transaction data. The interface option controls incoming and outgoing reports, file transfers, and interface modes (batch, contingency, or electronic). The systems utilities function performs systems diagnostics, and file transfers. The master data library can be updated by uploading it into the systems utilities function.

C. ADDITIONAL FUNCTIONS

1. General

ATLASS II+ provides inter-connectivity in order to support multiple Marine units at multiple sites, simultaneously. This is accomplished via a local area network (LAN) or wide area network (WAN).

2. Interface

ATLASS II+ interfaces with the following systems [Ref. 16]:

- Defense Automated Addressing System (DAAS)
- Federal Logistics System (FEDLOG)
- Marine Air-Ground Task Force (MAGTF) II family of automated information systems
- MAGTF Data Library (MDL)
- Standard Army Retail Supply System-Objective (SARSS-O)
- Shipboard Uniform Automated Data Processing System (SUADPS)
- SASSY

- Standard Accounting and Budgeting Reporting System (SABRS)

D.   FUTURE CAPABILITIES

1.   Overview

Acquisition strategy for ATLASS II+ provided for an open, standards-based architecture that will enable the exchange of information between other Defense Information Infrastructure (DII) Common Operating Environment (COE) compliant systems. [Ref. 17:pp. 3-4] The DII COE concept is an architecture that is fully compliant with the DoD Technical Architecture for Information Management (TAFIM). [Ref. 17:p. 20] It is also an architecture in which Global Combat Support System (GCSS) and Joint Computer-Aided Acquisition and Logistics Support (JCALS) Program have based their infrastructures. Compliance with these standards and architectures will allow flexibility and scalability into future versions of ATLASS II+. As such, future capabilities of ATLASS II+ have been identified but not yet fielded. The following present a highlight of future ATLASS II+ capabilities. For a complete listing see Appendix C.

2.   Maintenance Functions

Future versions of the Maintenance component will have the following functional capabilities: automated data collection and processing required to generate repair orders, capture input from a variety of test, measurement, and diagnostics equipment; store repair history of individual items to include information on parts required, Mean Time Between Failure (MTBF), Mean Time To Repair (MTTR), Repair Cycle Time (RCT) and cost to repair. [Ref. 13;p. 38-42]

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3. Supply Functions

Future Supply component capabilities will include improvements in the following areas: requisitions, property accounting, storage, fiscal, and managing data. Algorithms to forecast, track, and account for subsistence items, petroleum, oils and lubricants (POLs), ammunition, and medical items will make it easier to predict demand. These advanced algorithms will automatically determine the optimum stock rotations, and notify supply personnel of stock that has reached its end of service life.

Inventory or storage management will benefit by the capability to forecast inventory requirements based on real and projected data. Logistics specialists will have the capability to manipulate these data in order to predict requirements. Requirements include maintenance, supply, fiscal, ammunition, fuel, and medical.

4. Readiness Functions

Readiness reporting will be improved in a several ways with future add-ons to ATLASS II+. Automated data collection and processing of diagnostics and repair orders will provide a near real-time situational awareness of equipment condition. By providing a means to calculate MTBF, MTTR, and RCT, useful remaining life of components and end items may be predicted. Statistical process tools and scenario evaluation will also enable commanders to assess impact on readiness when certain variables (such as operational tempo, maintenance personnel, parts availability) are changed.

5. Inter-Connectivity

Inter-connectivity will be improved by incorporating Automatic Information Technology (AIT) to scan bar codes to identify and update equipment condition, and location.

6. INTERFACE

Future versions of ATLASS II+ will have the capability to interface with external systems that will provide support, such as transportation and wholesale supply systems. These include [Ref. 13]:

- Retail Ordnance Logistics Management System (ROLMS)
- Base Contracting Automated System (BCAS)
- Electronic Point of Sale (EPOS)
- TC-AIMS (Transportation Coordinators Automated Information Management System (TC-AIMS)
- War Reserve System (WRS)

IV. NAVAL AVIATION LOGISTICS COMMAND MANAGEMENT INFORMATION SYSTEM (NALCOMIS) ORGANIZATIONAL MAINTENANCE ACTIVITY (OMA)

A. BACKGROUND

Optimized NALCOMIS is a networked-based automated information system that integrates maintenance, material, and operations managers in the Navy and Marine Corps organizational and intermediate maintenance activities with timely, accurate, and complete information on which to base daily decisions in the management of assigned aircraft and equipment. [Ref. 18] It provides improvements over legacy NALCOMIS in the areas of automated logbooks, configuration management, and automated forecasting and tracking of maintenance schedules. [Ref. 19] Optimized NALCOMIS OMA links databases directly, thereby eliminating the requirement to prepare reports manually or request data from different sources (i.e., Navy Inventory Control Points (NAVICPs), DLA databases, and 3M NALDA databases). It also contains a back-up "replicator" system that provides mirror servers in order to maintain reliability and integrity of the overall system. It consists of NALCOMIS Intermediate Maintenance Activity IMA (formerly known as NALCOMIS Phase I and II) and NALCOMIS OMA (formerly known as NALCOMIS Phase III).

NALCOMIS IMA provides automated aviation intermediate level maintenance and administrative functions. It is deployed on aviation capable ships to include aircraft carriers and amphibious assault ships. NALCOMIS IMA is also resident in Marine Aviation Logistics Squadrons (MALS), and at Aircraft Intermediate Maintenance Departments (AIMD) of Naval Air Stations. NALCOMIS OMA provides aviation

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maintenance automation for Navy and Marine Corps aviation squadrons at the organizational level.

Optimized NALCOMIS is a next generation improvement over the legacy NALCOMIS and performs as a single, real-time, automated Management Information System (MIS). It runs on a client/server architecture that consists of workstations, servers and a local area network, a Graphical User Interface (GUI) and a relational database management system (RDBMS). [Ref. 18]

Design intent of Optimized NALCOMIS was to provide detailed processes to collect, enter, process, store, review, report, and interface data required by maintenance activities. These automated processes support aircraft, engine and aviation support equipment repair; supply requisitions, material control; personnel, aircraft and equipment training and usage; and resource allocation and usage. [Ref. 21] NALCOMIS OMA is networked and interfaces with NALCOMIS IMA by using shipboard or ashore local area network (LAN) in order to exchange certain functional information. This information consists of squadron supply requisitions, requisition status queries and work order data. NALCOMIS OMA accepts input, formats the data, and electronically transmits it to NALCOMIS IMA. NALCOMIS IMA accepts the OMA data and provides feedback through either error messages or requisition confirmation. This networking facilitates the instantaneous, and accurate exchange of data that improves communication and reduces response time of the supply and maintenance system. Improved communications and reduced response time translates into increased material readiness.

The objectives in fielding Optimized NALCOMIS were to improve mission capability, to improve aircraft maintenance and support, to improve readiness reporting

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and to modernize management support. [Ref. 18] Key features of Optimized NALCOMIS include real time functionality, flight time documentation and configuration management. Optimized NALCOMIS OMA capabilities are highlighted in the following paragraphs. For a detailed listing of current and projected capabilities see Appendix D and Appendix E.

B. CURRENT SYSTEM CAPABILITITES

1. Overview

Optimized NALCOMIS OMA consists of seven components (see Figure 4.1). There is a Flight Subsystem, Configuration Management Subsystem, Maintenance Subsystem, Material Control Subsystem, Personnel Subsystem and a utility subsystem whereby "ad hoc" reports may be generated. [Ref. 22] The Flight Subsystem component is capable of tracking and monitoring the type and amount of flight time against aircrew and aircraft. It also includes a capability to plan flight schedules as far as one month in advance. The Configuration Management Subsystem tracks all necessary components that are life- limited and that require a detailed record history. It may also be used to forecast scheduled maintenance, track all changes, and track technical directives incorporated into a component. The Maintenance Subsystem documents all scheduled and corrective maintenance for aircraft and components. It provides the capability to list all parts and maintenance actions required to repair an item. It also has the capability to track all maintenance activity from squadron detachments. The Material Control component of NALCOMIS OMA provides the capability to add, update or delete information pertaining to the requisition of parts. The Personnel Component provides the capability to manage personnel schedules and training qualifications. The Reports utility component provides the capability to create and run customized and standard reports.

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ELAS

AAAV AL INPUTS   Optimized NALCOMIS OMA

•Historical Data
•IETM
•Operational Information
•Diagnostics
•Prognostics
•Vehicle Inventory
•Vehicle Logbook

•Flight Subsystem

•Configuration Management Subsystem

•Maintenance Subsystem

•Material Control Subsystem

•Personnel Subsystem
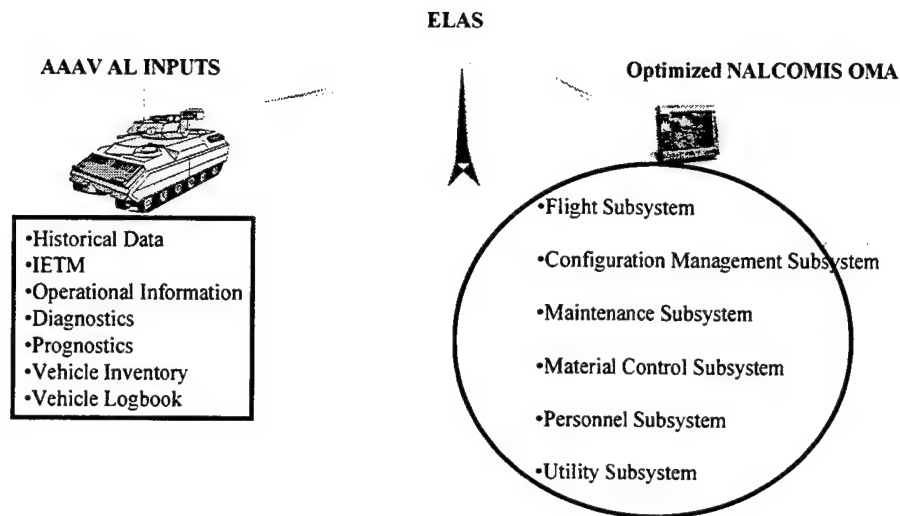
•Utility Subsystem

Figure 4.1   AAAV Data Stream into Optimized NALCOMIS OMA.

2.   Flight Subsystem Functions

The Flight Subsystem component of Optimized NALCOMIS OMA provides the functional capability to collect and process flight related data. This includes documenting the flight, scheduling the flight, approving the flight, and reporting it. This subsystem has significantly improved readiness reporting and flight hours, which drives funding and tasking. Typically, flight hour reporting has been mismatched in earlier systems. Now it is a shared database between operators and maintainers creating consistency in reporting. Flight hours that are documented in this subsystem directly affect the Maintenance and the Configuration Management components.

The Flight Subsystem has four elements within it that enable all pertinent information to be captured and processed. There is a flight document element, a scheduler element, an approval element and a reports element. The flight document

element provides the capability to initiate, modify, and delete data or complete flight documents for normal flights, other activity or simulator flight. It accomplishes this by direct input and viewing of data on current as well as historical flight document pertaining to aircraft, aircrew, flight legs, types of mission, types of weapons loads and flight hours. [Ref. 18]

The scheduler element of the Flight Subsystem provides the capability to view previously scheduled flight events, modify existing ones, or to add new ones by scheduling by flight, aircrew or crew activity. Aircraft can also be scheduled by flight event. The Flight Subsystem provides data for aircraft that are available, the missions and times of events. Aircrew may also be scheduled based on training and proficiency. Training departments can implement training code categories to track specific mission training requirements and qualifications. This significantly reduces the amount of time required to write training and readiness reporting. A Watch Bill function is also embedded in order to complete personnel scheduling based on requirements and available personnel. An additional functional capability that exists within the scheduler element is the ability to compute astronomical data based on time, date and location. There is also a function called the snivel log that allows for the scheduling of aircrew or crewmembers that will not be available for a flight on specified days. There is also a reports capability that allows a detailed daily, weekly or monthly flight schedule to be made that includes all the aforementioned scheduling information. [Ref. 18]

The approval element of the Flight Subsystem component provides the capability for authorized individuals to access specific or all documents for review and approval. This includes access to aircrew, flight, departure and aircraft documents. There are a

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variety of aircrew documents that need approval prior to and upon completion of flights. These include maintenance action forms and training qualifications requirements. Flight document approval provides the capability to approve documentation for normal, tactical and simulator flights that pertain to aircraft, aircrew, flight legs, missions and weapons loads. The departure approval element displays the aircraft departure data for a specified document number. The aircraft approval element displays aircraft data for a specified document number. There are two additional functions within the approval element: the aircraft master records query and the individual aircrew history query. These allow for the viewing or printing of all aircraft records and flight history of an aircrew based on selected aircraft.

The reports element of the Flight Subsystem component provides the capability to generate flight-related reports of aircrew, aircraft, flight training, aircrew flight summary by type equipment code (TEC), social security number and individual master roster (IMR). Additional functions for generating reports include aircraft landing and mission summary, completed documents by aircraft as well as installed engine. There is also a personnel reports function that provides the capability to generate personnel data reports for specific, multiple or all assigned personnel to the squadron.

3. Configuration Management Subsystem

The Configuration Management Subsystem of Optimized NALCOMIS OMA provides the capability for authorized users to maintain configuration profiles on aircraft, engines, propellers, modules, and components assigned to the maintenance activity. [Ref. 18] These configuration profiles were all previously stand-alone systems that did not interact and required frequent updates. As aircraft changed reporting activities, errors in

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historical data would often result. Now with a central database, accurate data on critical components can be ensured.

The Configuration Management Subsystem is loaded with a designated baseline manager as designated from the program manager's office. This baseline manager creates, loads and maintains baseline data that is critical to effective functioning. [Ref. 19] This baseline data are electronically replicated throughout the system down to the organizational level. All available records defined in the baseline are automatically tracked. This automatic tracking provides for total asset visibility of all components down to type, model, and series (T/M/S) of aircraft. This provides the capability to process usage of life-limited component (LLC) replacement, technical directive (TD) scheduling, maintenance execution and data entry, as well as the continued provision of asset visibility.

The Configuration Management Subsystem also provides the capability to automatically and accurately list all components, engines, aviation life support systems, supporting equipment and warranted items whether they are installed or uninstalled on aircraft. These tracked items often have limited life; therefore, tracking usage indicators provide a traceable history in order to schedule replacement and forecast remaining useful life. The Configuration Management Subsystem is also capable of operating in a stand-alone mode for indefinite periods. Once the network comes on-line again, the updates are accomplished automatically.

Automatic life-long tracking of components and usage indicators enable life cycle managers at all levels to provide better service life management.

4. Maintenance Subsystem

The Maintenance Subsystem of Optimized NALCOMIS OMA provides the capability for authorized maintenance personnel to induct and document scheduled and corrective maintenance of aircraft and other end items assigned to the squadron. [Ref. 18] It provides maintenance personnel at the organizational level the capability to update, or query work orders, to requisition parts and to sign off all maintenance and material requirements. The Maintenance Subsystem also provides the capability to account for tools, and maintenance personnel performance.

Aircraft are inducted into the maintenance cycle through the use of pre-formatted work orders. These work orders may be initiated for scheduled, unscheduled, unscheduled inspection, near due inspections/component removal, fix phase, one time inspection and duplicate, contingency and recurring maintenance activities. Once the work order is inputted, the system maintains the capability to query active and historical work orders. Active work orders are those maintenance actions that contribute to the current maintenance status, while historical work orders are those that are completed and are now archived. This allows visibility throughout the squadron on the counts of all work orders, by status, against each aircraft in the organization. As work is completed, the Maintenance system automatically updates entries from actions on the work orders.

Requisite parts may be ordered through the system by several methods. Once a work order is initiated, the Maintenance Subsystem has the capability to display the failed part(s) and requisition details. It enables the maintenance personnel to identify and order replacements for items that failed due to damage or defect from normal wear or when the operational limits have been reached. [Ref. 18] These consumable parts, and repairable

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parts may be ordered by click and drag options. Cannibalization of parts may also be documented by using the cannibalization wizard section. Upon authorization, the cannibalization wizard automatically identifies the part number and serial number of the item to be removed from the source aircraft and installs it to the target aircraft. The process also transfers the replacement document number of the removed component to a new work order initiated against the source aircraft.

The Maintenance Subsystem also maintains the capability to generate reports related to aircraft, support equipment, aviation life support system (ALSS) equipment and Mission Mounted Equipment (MME). Aircraft daily status, aircraft material status, subsystem capability and impact reporting (SCIR), work center workload report, aircraft/equipment workload. Additionally, there are several inspection reports that can be generated. These include inspections by assembly, scheduled inspection reports, and maintenance history reports.

Support equipment may also be managed through the Support Equipment option. This will display the current status of related work orders and counts for that item. The ALSS option displays the current status of all ALSS items at the squadron. This also allows the maintenance personnel to view the list of ALSS work orders and counts by work order status. The MME option displays the current status of all MME. It also lists the work orders and counts by work order status. The status of support equipment, ALSS, and MME are updated automatically as counts are finished. ALSS and MME had separate software programs previously. Typically, these were hard hit areas of command inspections because of deficient configuration management of software versions.

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An additional new capability is the detachment module. Some squadrons such as H-60 helicopter squadrons typically deploy stand-alone detachments to multiple ships/sites. In the past, aircraft maintenance and flight hour reporting was conducted via regular message traffic. This caused time delay and accuracy problems in reporting. This new capability will consist of a detachment module that is accompanied by a small detachment network with a mini server and laptop computers. This capability will automate the maintenance reporting system for detachments, resulting in improved timeliness and accuracy.

5. Material Control Subsystem

The Material Control Subsystem of Optimized NALCOMIS OMA provides the capability to track components on order against either the aircraft or an end item. This subsystem is important in that it provides material control processing interface between NALCOMIS OMA and NALCOMIS IMA. The Material Control Subsystem also provides the capability to initiate the requisition status update process. From the OMA level, a request to update the supply status of all outstanding requisitions on the IMA database is begun. This query on demand will be answered automatically by the IMA back down to the OMA. Previously, the IMA portion was updated with a batch process. Status on job order numbers (JON) was never true. Now these are real time.

6. Personnel Information Subsystem

The Personnel Subsystem of Optimized NALCOMIS OMA provides the overall capability to manage personnel, qualifications, training and work center assignments. Managers have the capability to add or remove personnel to or from work centers based on qualifications and assignments. Activity Manpower documents can be integrated into the database template, thereby easing the manpower reporting process. Depending on

authorization level, this system provides the capability to access a user record within the squadron. Upon access, training records can be updated; job assignments modified and work center assignments delegated. The same subsystem also provides aircrew flight qualifications data and flight time history of individuals. These aspects are critical to effectively matching resources and training with maintenance requirements.

7. Ad Hoc Reports Utility

The Ad Hoc Reports Utility provides the capability to create customized queries to meet the application's requirements. This assists maintenance personnel in managing assets and reducing labor hours expended by manually processing data. Ad Hoc queries function in two modes, normal and expert. Normal mode enables personnel to select a subsystem and data elements related to the subsystem. The system determines table links and automatically creates those. Expert mode provides the capability to select from tables in the database and columns representing the data elements.

C. FUTURE SYSTEM CAPABILITIES
1. Platform Software Interface Subsystem

Currently under development is an additional capability which when fully operational will enable the transfer of information from aircraft directly into Optimized NALCOMIS OMA. This new subsystem will be called the Platform Software Interface Subsystem. [Ref. 20] NALCOMIS OMA will have the capability to extract data from "smart" aircraft from each flight. This information will then be processed by the Flight Subsystem and subsequently inducted throughout the system including high time data in the configuration management subsystem and maintenance action form generation with direct troubleshooting data. Data to be extracted from "smart" aircraft include:

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- Engine Monitoring System data
- Flight Control System data
- Avionics System data
- Fault codes
- Component life time/cycle time data
- Diagnostics data
- Engine Life Usage Indices (LUI)

The Platform software Interface Subsystem will also have the capability to debrief the aircrew and maintainers from fully integrated Interactive Electronic Technical Manual (IETM). Additionally, advanced diagnostics and prognostics capability from the aircraft and engine will interface with NALCOMIS for direct data transfer of performance information.

V.   ANALYSIS

A.   PURPOSE

The previous chapters were devoted to identifying the capabilities associated with the Autonomic Logistics (AL) capability of the AAAV, ATLASS II+ and Optimized NALCOMIS OMA.   ATLASS II+ and Optimized NALCOMIS OMA have distinct advantages and disadvantages in their ability to accept, manage and process information available from the AAAV.   This chapter analyzes the capabilities, as well the opinions and interpretation of the material presented in previous chapters.   Its purpose is to provide an evaluation of the capability of ATLASS II+ and Optimized NALCOMIS OMA to support the Autonomic Logistics inputs of the AAAV.

B.   BACKGROUND

An analysis was conducted between those capabilities listed for the AAAV in Appendix A and those current and future capabilities of ATLASS II+ and Optimized NALCOMIS OMA listed in appendices B thru F.   While examining each system's ability to support the real and near real-time generation of performance data of the AAAV, the researcher referred to three common over-arching goals of fielding ATLASS II+ and Optimized NALCOMIS OMA.   These goals are (1) to provide asset visibility, (2) improve accuracy and timeliness of information and (3) to reduce manual processing.

C.   COMPARISON OF ATLASS II+ TO AAAV

Discussed below are the advantages and disadvantages of adopting ATLASS II+ to support the AL inputs of the AAAV.

1. **Advantages**

   a. *Asset Visibility*

   In terms of meeting the overarching goal of improving AAAV asset visibility through the adoption of ATLASS II+, three capability areas provide advantages. These areas include a general areas advantage, maintenance area advantage and a supply area advantage.

   (1) General. ATLASS II+ capabilities provide an advantage in accepting AL inputs of the AAAV in the following ways.

   - Provides near real-time visibility of equipment readiness to customers
   - Provides inter-connectivity to support multi-location MAGTFS
   - Provides a capability to pass to and view a data repository

   These general capabilities combine to provide the AAAV an advantage providing real time visibility of assets, in disparate locations, with a capability to share information.

   (2) Maintenance. ATLASS II+ Maintenance can provide the capability to track components of an end item that is in maintenance from location to location. Additionally, AAAV maintenance personnel will have the capability to provide data input thru ATLASS II+ via remote access from the work site or at some other physical location. Asset visibility is also improved through ATLASS by providing the capability to track locally, repair parts that are not yet applied to an item.

   (3) Supply. Supply functions of the AAAV are leveraged through the adoption of ATLASS II+ in the following manner. AAAV will typically operate in detachments depending on MAGTF composition. ATLASS provides the supply asset visibility capability to respond to the reconfiguring of the MAGTF organization following activation or deactivation. This will enable supply support to

AAAV detachments to continue uninterrupted throughout MAGTF activation. For the parent AAAV supply organization, ATLASS provides the advantage to the supply technician of being able to manage multiple location accounts.

Additional supply asset visibility advantages of adopting ATLASS II+ to support the AAV include, the capability to track status of customer requirements, equipment condition, shipping status, inventories and maintaining current information. This facilitates real-time visibility of equipment status and situational awareness by a responsive supply and maintenance system.

b. *Improving Accuracy and Timeliness of Information*

(1) General. ATLASS II+ strives to automate and minimize the manual input of data at all levels. Although there remains a significant deficiency (to be discussed later) in the capability to automatically process data into ATLASS II+ electronically, once the data are entered, there are capabilities that make the exchange of data easier. For example, ATLASS II+ provides for data validation at time of entry, with the elimination of obscure data. There is a standardized user interface across all applications using source data with restricted access. This provides accurate and timely electronic transmission of requirements of maintenance, supply, or technical reference data. ATLASS input is event driven, thereby minimizing manual input requirements. An additional advantage of using ATLASS for processing AAAV AL inputs is the capability to operate ATLASS when disconnected from the communications network/LAN. The AAAV has the capability to constantly collect and transmit data as operational security permits or will be able to deliver on demand requisite performance information. ATLASS will process information as it is received thereby maintaining responsiveness.

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(2)   Maintenance. AAAV maintenance advantages in ATLASS are its capability to support a paperless environment based on automated equipment records, with electronic access to this information to generate repair orders and order parts. This also provides for real-time status response on parts supplies/requisitions. As maintenance and supply actions change, these changes are updated throughout the system by a cascading update capability. In ATLASS, maintenance personnel have the capability to provide data input via remote access from the actual work site. This is in keeping with minimizing the reliance on AAAV organizational maintenance personnel and favoring embedded prognostics and diagnostics. ATLASS provides for automatic user updates for modifications, calibrations and warranty service work.

(3)   Supply. ATLASS II+ can accept supply information from the AAAV in two ways. It provides the capability to respond to the reconfiguration of task organizations in order to provide uninterrupted supply support to the customer and continuously optimize the distribution system. ATLASS automatically tracks customer requisitions, equipment condition, shipping status and inventory management. Inventory management includes automatically tracking temporary loan accounts, monitoring status of on-hand accounts and calculating stock objectives as well as reorder points based on projected and actual demand. These algorithms will remove a lot of variability from the system thereby improving efficiency and providing the correct support to the right requirement. An additional supply capability provided by ATLASS is its ability to designate a priority of support sequence for supported units. User or mission defined constraints will take advantage of the AAAV capability to monitor fuel and ammunition

levels. Once a vehicle reaches certain mission defined parameters, it initiates a re-supply order. This helps to optimize distribution assets for combat service support units.

c. *Reduce Manual Processing*

(1)   General.   ATLASS II+ reduces the need for manual processing considerably once the initial work orders are initiated. It supports the electronic transmission requirements throughout the system while it captures repetitive information to minimize keystrokes requirements and permits all information to be shared.

(2)   Maintenance.   Scheduled   maintenance   may   be automatically generated based on miles driven, hours operated, rounds fired or calendar days. Other types of maintenance such as preventive, calibration and modifications may also be automatically scheduled and batch processed if required either by vehicle use or electronic technical instruction. This capability will be able to take advantage of data captured by the AAAV. Additionally, historical data for twenty-seven months may be archived in ATLASS. This will allow for trend analysis of component and end item reliability and failure indicators such as MTBF, MTTR and RCT to be calculated and forecasted.

2.   Deficiencies

Deficiencies currently exist between what the AAAV is capable of providing and what the currently fielded version of ATLASS II+ can accommodate. Though future versions of ATLASS are expected to possess these capabilities, they are not currently fielded and therefore viewed as deficiencies.

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ATLASS II+:

- Currently lacks capability to automate the data collection and processing of information

- Lacks the capability to automatically manage Configuration Management of end items and components

- Inability to capture input from TMDE

- Inability to interface with external systems that provide support such as wholesale supply support and transportation systems

- AIT deficiencies

- Automated tracking of vehicles

Automated data collection and processing is perhaps the most serious deficiency that exists. Without the capability to automatically and electronically accept the data the AAAV can provide, ATLASS is nothing more than an electronic version of the manual paper system it replaced. Along with the automated data collection deficiency is the inability to automatically capture TMDE input. ATLASS cannot take advantage of the diagnostics, prognostics and IETM information processed by the AAAV until it is electronically transferred to ATLASS in a manner which will anticipate component failure, and automatically place parts on order. This data when collected over time will enable maintainers, supply-personnel to make better decisions about life-cycle management. Such data include information on parts required, MTBF, MTTR, RCT and cost to repair.

A Configuration Management capability is an additional deficiency in ATLASS II+. It does not provide the means to identify, track and control configuration profiles on AAAVs. This includes engines, software versions, weapons systems and components assigned to the organization. A configuration management capability in ATLASS would

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provide the ability to process usage data of component replacement, technical directive scheduling changes, maintenance execution as well as continued asset visibility.

ATLASS does not currently interface with external systems that provide support such as wholesale supply systems and transportation systems. This will limit the ability of ATLASS users to locate and access parts information as well as to track shipments throughout the system. Although it does interface with DAAS, FEDLOG, SARSS-O, SASSY, SABRS and MAGTF-II LOG AIS, it does not interface with ROLMS for ordnance ordering or BCAS for contracting support. ATLASS also does not currently interface with EPOS, the War Reserve System or the Marine Corps transportation automated information system.

Current versions of ATLASS do not have the capability to incorporate AIT to scan bar codes to identify serial numbers or track container contents. This deficiency will affect inventory control, manifests and configuration management necessitating continued reliance on manual input and accounting.

ATLASS does not currently possess the capability to automatically track vehicles. Automated tracking will allow the system to apply a physical location to a vehicle or component. When combined with the capability to electronically generate a work order when an AAAV requires repair, the work order will be generated with location and type of repair action necessary. The maintainers will know vehicle location, parts and tools required and problem with the vehicle. Taken another step, transportation requirements can also be concurrently generated.

D.   COMPARISON BETWEEN OPTIMIZED NALCOMIS OMA AND AAAV

Although very similar in design to ATLASS II+ and managed by the same command (SPAWAR), Optimized NALCOMIS OMA (ONO) was designed and fielded for the aviation community and is based on its principal metric, flying hours.   ONO possesses many similar capabilities to ATLASS II+ and as such I will attempt to focus on the distinguishing advantages and disadvantages it offers in support of the AAAV.   The following paragraphs describe those advantages and disadvantages of applying ONO to the AL inputs of the AAAV.

1.   Advantages

Within ONO, there exist functional capabilities which the AAAV could take advantage.   These advantages reside in the Flight Subsystem, Configuration Management Subsystem and the Maintenance Subsystem.

a.   *Flight*

The Flight Subsystem provides the functional capability to collect and process all flight related data.   This is an advantage because not only does this subsystem schedule, document, approve, and report the flight but the information (i.e., flight hours) are documented and directly affect the maintenance and configuration management components.   Applied to the AAAV, data such as engine hours, miles driven, rounds fired and calendar days would be documented and affect not only the maintenance subsystem as in ATLASS but also the configuration management subsystem.

b.   *Configuration Management*

Perhaps the greatest advantage NALCOMIS maintains over ATLASS is the capability to maintain configuration profiles on aircraft, engines, propellers, modules and components assigned to the organization.   The Configuration Management

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component also maintains the capability to automatically track all components, engines, ALSS, MME, SE and warranted items whether installed or not. The capability to track usage provides a traceable history in order to schedule replacement of the item and to forecast such indicators as MTBF, MTTR and RCT.

c. *Maintenance*

Two aspects of the maintenance component would provide capability advantages for the AAAV. The first is a cannibalization module. This module, upon authorization, automatically identifies the part number and serial number of the item(s) to be removed from a cannibalized aircraft and gives it to the downed aircraft. This module also transfers the replacement document number of the removed component to a new work order for the source aircraft. Although cannibalization is not an action regularly taken in Marine Corps ground maintenance, it does occur. This provides a means to document and track it.

An additional advantage of this maintenance component is a detachment module. It consists of a small detachment network with a mini-server and laptops to automate the maintenance reporting system. This gives a detachment self-reliance on maintenance induction rather than relying on host units to support it with computers, space, etc.

2. Disadvantages

The most significant disadvantage of ONO is the inability, just as in ATLASS, to automatically and electronically transfer information from aircraft directly into the system. Currently under development, this capability known as Platform Software Interface Subsystem will enable a future version of NALCOMIS to extract data from

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"smart" aircraft after each flight. This information will then be processed by the Flight component and, in turn, be inducted into the maintenance and configuration management subsystems. Aircraft such as the F/A-18 E/F, MV-22 and JSF will take full advantage of their embedded capabilities and download directly into the NALCOMIS system. A similar capability would allow the AL inputs of the AAAV to be fully integrated into the Marine Corps supply and maintenance system.

VI.   CONCLUSIONS AND RECOMMENDATIONS

A.   INTRODUCTION

The development and fielding of the AAAV is ripe with opportunities and challenges for operators, logisticians and life-cycle managers. The autonomic logistics (AL) capabilities of the AAAV provide unprecedented access to near and real-time performance information. This access to information provides challenges to the Marine Corps ground supply and maintenance system in its ability to receive and process the information as quickly as it can be generated. The objective of this thesis was to determine whether current and projected automated supply and maintenance management systems as ATLASS II+ or Optimized NALCOMIS OMA are capable of supporting the AL inputs of the AAAV. To explore this subject, the researcher reviewed current and projected functional capabilities of ATLASS II+ and Optimized NALCOMIS OMA and spoke to subject matter experts. The functional capabilities of ATLASS II+ and Optimized NALCOMIS OMA were examined in order to determine the ability of each to support the AL inputs of the AAAV. This chapter presents the conclusions of this thesis, offers recommendations, and suggests areas for further research.

B.   CONCLUSIONS

The following are specific conclusions drawn from this study:

- The current fielded version of ATLASS II+ cannot currently support the autonomic logistics inputs from the AAAV.

- The current fielded version of Optimized NALCOMIS OMA cannot support the autonomic logistics inputs from the AAAV.

- There is a significant performance gap between the information that a AAAV can provide and the information that automated supply and maintenance management systems are capable of supporting.

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- Development of future capabilities of ATLASS II+, as listed in Appendix C, will enable it to process AAAV inputs

- Development and adoption of certain functional capabilities, as listed below, will enable the AAAV inputs to be processed and managed.

C. RECOMMENDATIONS

I believe implementation of the following recommendations will enable ATLASS II+ to manage the AL inputs of the AAAV. Implementation of these recommendations will provide a solid capability from which operators, commanders, logisticians and life-cycle managers can fully optimize the AL information.

- **Develop Optimized NALCOMIS OMA capability known as Platform Software Interface Subsystem and incorporate into ATLASS II+.**

  Rationale: This capability will enable ATLASS II+ to overcome its principal deficiency: the inability to automate the data collection and processing of information, to include capturing input from TMDE.

- **Incorporate Configuration Management Subsystem from Optimized NALCOMIS OMA into ATLASS II+**

  Rationale: This will provide the AAAV community, logisticians and life cycle managers the ability to automatically track all components, engines, support equipment and warranted items throughout the life of each AAAV.

- **Develop ATLASS II+ capability to incorporate AIT to scan bar codes**

  Rationale: This capability will enable automated data collection for configuration management, inventory control and accounting purposes.

- **Develop ATLASS II+ interface capability with external wholesale supply and transportation systems such as EPOS, War Reserve System and Marine Corps Transportation AIS**

  Rationale: Continued development of this capability will provide ATLASS users such as the AAAV community, ability to locate and access parts information as well as to track shipments.

- **Incorporate Cannibalization Mode of Optimized NALCOMIS OMA Maintenance Subsystem into ATLASS II+**

  Rationale: Cannibalization occurs. This capability will provide a method to identify, track and order cannibalized parts.

- **Develop a capability in ATLASS to automatically accept position data of an AAAV**

  Rationale: Location data of AAAV or components can be a data field that will be filled when a work order is generated. This will facilitate asset visibility in order to plan for dispatch of maintenance teams and coordination of transportation.

D.   SUGGESTED TOPICS FOR FURTHER RESEARCH

During the course of this thesis, other areas were identified that may warrant additional study. Addressing these areas was beyond the scope of this thesis. The following are presented for future research:

- A cost/benefit analysis to determine the extent to which Marine Corps ground equipment be equipped with the autonomic logistics capability. Should all Marine Corps ground equipment possess the autonomic logistics capability? Where should the cutoff be?

- Conduct a market survey to determine private sector capabilities for prognostic health monitoring and applicability to Marine Corps ground equipment. Is there a private sector capability already in use that could be adopted and implemented by the Marine Corps?

- Conduct an analysis of the potential effects that autonomic logistics has on overall operational availability (A_o). Specifically, look at one component of the A_o equation, administrative delay time (ADT). ADT often comprises a large proportion of total maintenance downtime (MDT). By reducing ADT through autonomic logistics, how much will operational availability be increased?

- Conduct an examination of methodologies used by maintenance personnel to act on the information provided by autonomic logistics. Do they have the tools and were identified processes established to act on this information in order to decrease maintenance downtime of equipment?

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APPENDIX A. AUTONOMIC LOGISTICS INPUTS FROM AAAV

Vehicle Data	AAAV INPUTS
Vehicle Serial Number	X
Hours	X
POL Usage	X
Fuel Usage	X
Subsystem Test Status	X
Modifications	X
Engineering Change Proposals (ECPs)	X
Software Version	X
Prognostics	X
Vehicle Configuration (includes: ECPs/software version/IETMs/Embedded Training version/C^{4}I version/LRUs/End items	X
Daily Logbook	X
Monthly Logbook	X
Filter	X
Component Failure/Replacement	X
Weapons Data Logbook	X
Calibration	X
Maintenance Action	
Equipment Repair Order (ERO) Number	X
Job Order Number (JON)	X
Reporting Unit Code (RUC)	X
Requisition Date	X
Nomenclature	X
National Stock Number (NSN)/Part(s) Number(s)	X
Cage Code	X
Weapon Status Code	X
Date of Request	X
Priority of Request	X
Priority for Each Repair Part	X
Unit Price	X
Defect Code	X
Echelon of Repair	X
Quantity of Part(s) Reqrd	X
Forms	**AAAV INPUTS**
PMCS Checklist	X
Operations Checklist	X
Pre-water Checklist	X
Technical Manual Change Request	X

Limited Technical Inspection (LTI)	X
Weekly/Monthly Checklist	X
Equipment Repair Order (ERO)	X
Equipment Repair Order Shopping List (EROSL)	X
Daily Processing Report (DPR)	X
Ammunition Malfunction Report	X
Embarked Troop Manifest	X
Range Card	X
VMF/USMTF/OTH Gold	X
SM/TI Record	X
Situation Report	X

APPENDIX B. CURRENT FUNCTIONAL CAPABILITIES OF ATLASS II+ (AFTER REF. 12)

GENERAL

- Provides managers the means to process requirements for organizations identified as a non-supported organization

- Provides visibility of equipment readiness to customers

- Provides inter-connectivity to support multi-location MAGTF's

- Provides for data validation at time of entry

- Provides transparent inter-connectivity between mutually supporting functions

- Provides the capability for organizations to identify specific items for readiness tracking

- Provides a standardized user interface across all applications

- Provides for source data file edit access to be restricted at various levels

- Provides for the elimination of obscure data entry requirements

- Provides for system administrator to control access to data by assigning each user levels of access/authorization

- Provides for command level system administration to establish authorized user accounts

- Provides for system automatic and on-demand data back-up

- Provides for compatible communication protocols with existing tactical and commercial applications

- Provides for regional networking capability

- Provides support to deployed and static organizational structures

- Provides the capability to estimate training budgets, exercise budgets, and actual deployment budgets by interfacing with historical data, from both supply and maintenance

- Provides for accurate communication with the transportation components of the system regarding information to manage the distribution process

- Provides for detailed on-line help, in order to offer explanations to better utilize the system

- Provides for the electronic transmission of requirements from supported units to supporting units and vice versa

- Provides for the sustaining of forces of any size up to two MEF's during peacetime, war, or contingency operations

- Provides for the passing of local procurement request data to a web-enabled, Value-Added Network (VAN)

- Provides for consistent escape routes when operator errors are made

- Provides for the minimization of keystrokes required to capture information

- Provides for the facilitation of capturing repetitive information in order to minimize keystroke entry of similar information

- Provides for an ad hoc query capability

- Provides a means to initiate updates to technical references with information changes generated from the field

- Provides for the capability to track budget allowance, obligations, and funds expended

- Provides a capability for the system to be event driven (input requirements are minimized and support the processes as they are driven by events)

- Provides the capability to track expenditures obligated for non-supported units (e.g. other Services)

- Provides the capability to track budget related items that originate in other aspects of the system or from external systems, and make necessary adjustments

- Provides for a standardized data dictionary that addresses all logistics disciplines

- Provides a capability to pass to and view a data repository

- Provides for a capability to deploy within twenty-four hours an organization configured as a MAGTF

- Provides for the capability to operate when disconnected from the communication network/LAN

MAINTENANCE

- Provides for the capability to track components of an end item that are in maintenance from location to location

- Provides for the capability to automatically generate scheduled maintenance based on miles driven, hours operated, rounds fired, or calendar days

- Provides the capability to support a paperless maintenance environment based on automated equipment records, with electronic access to this information in order to generate repair orders and order parts

- Provides access to item repair history to suggest variation of standard preventive maintenance schedules and/or parts packages

- Provides for the means of adding, editing, or deleting customer information at he appropriate level

- Provides the capability to group common maintenance of similar items by supporting batch processing of repair orders

- Facilitates generation of new or subordinate work orders when conditions dictate that current work orders are inadequate to manage specific equipment maintenance

- Provides the capability for maintenance personnel to provide data input via remote access from the actual work site

- Provides identification of discrepancies in the maintenance process to managers

- Provides a means for managers to intervene in the maintenance process as permitted by their level of access

- Provides a capability to automatically notify user or required preventive maintenance during initial equipment inspections

- Provides the capability to print receipts for equipment exchanges on an as required basis

- Provides the means to allocate/reallocate resources to a specific maintenance requirement

- Provides for a requisition of repair parts based on anticipated need

- Provides for prioritization of work orders based on the requestor's FAD, and urgency of need

- Provides a capability for managers to track maintenance personnel assigned and/or available for specific maintenance tasks

- Provides for a capability to track locally, repair parts that are not yet applied to an item in maintenance

- Provides for near real-time status response on parts/supplies requisitions

- Provides the managers the capability to notify customers/users when customer requirements do not contain the required information or when proper conditions do not exist to fulfill the requirement

- Provides the capability to calculate readiness at the organizational level for Communications/Electronics, Engineer, Motor Transport, and Ordnance assets

- Provides the capability to project future calibration requirements and automatically initiate the calibration repair order when calibration is due

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- Provides the capability to automatically prepare for approval all maintenance requests that meet acceptance parameters

- Provides the capability to export readiness data in a format useable by the Status of Resources and Training System (SORTS)

- Provides the means of ordering standard preventive maintenance parts packages based on type of scheduled maintenance and type of equipment

- Provides using units the capability to determine the calibration status of any owned item

- Provides the capability to managers to process maintenance requirements for organizations that are identified as non-supported

- Provides the capability to facilitate entry of repetitive information

- Provides the tools to assist projecting and scheduling preventive maintenance and calibration

- Provides the capability to accumulate maintenance cost data by fund code, individual item, class of items, and organizations

- Provides the means to capture and access maintenance actions performed by contractor or by manufacturers performing warranty service

- Provides the capability to automated parts requisitions process by transparently converting parts requirements into appropriate supply transactions

- Provides the capability to store modification histories of specific end items

- Provides for remote access to the maintenance AIS at the work site

- Provides for a cascading update capability that modifies relevant records when a requirements or condition changes

- Provides for a capability to automatically notify user of modification status during initial equipment inspections

- Provides the means to identify personnel to be granted access to delete or cancel work orders

- Provides the capability to differentiate among specific maintenance tasks on a given piece of equipment

- Provides the using unit with a semi-automatic notification of modifications due

- Provides for a capability to automatically review calibration status if an item is transferred to an intermediate maintenance facility

- Provides for the system to convert the functional concept of a Pre-Expended Bin (PEB) to a supply warehouse location

- Provides the capability for the maintenance managers to track tools (either sets, components, or individual tools)

- Provides a capability for the system to facilitate realigning maintenance support when deactivating organizations

- Provides automatic verification that the customer is on a list of supported activities

SUPPLY

- Provides the capability for the system to allow user-defined parameters that are used to adjust discrepant physical inventories

- Provides the capability to respond to the reconfiguring of parent organizations following MAGTF deactivation

- Provides the capability to General Account Managers to manage a multiple location general account

- Provides the capability to track status of customer requirements, equipment condition, shipping status, inventories, and to maintain this information current to within the most recent eight (8) hour period

- Provides supply managers the capability to designate constraints on issuing an item

- Provides the capability to allow managers to designate an item as readiness reportable at his organizational level and below

- Provides the capability for the system to generate requirements based on status of on-hand assets

- Provides highly flexible physical inventory control and management capability

- Provides the capability to automatically source requirements that meet all acceptance parameters

- Provides the capability for the supply manager to designate local source of supply for specific NIINs in lieu of the source identified in technical reference data

- Provides the capability to track authorized allowances and on-hand status of equipment and supplies by unit, status, and location

- Provides the capability to automatically perform an interchangeability/substitutability check to identify alternative items

- Provides the capability to enable simplified allowance/equipment reallocation process

- Provides for the capability to facilitate supply management when deactivating organizations, e.g. a combat service support detachment

- Provides the capability to calculate deployment block requirements by IIN, quantity, cost, required delivery date, and probable location

- Provides the capability to accommodate the means to return to stock, items that have been identified as serviceable components and/or parts removed from end items during salvage operations or during secondary reparable maintenance

- Provides the capability to track requisitions due by quantity, date, recipient, and mode of shipment for the following classes of supply: Class I, II, III, IV, VII, VIII, and IX

- Provides the capability to track temporary loan accounts by NIIN, TAMCN, responsible officer, location, and due date, at a minimum

- Provides the capability to monitor status of on-hand assets by commodity, amount, condition, location, and special handling requirements for the following classes of supply: Class I, II, III, IV, VII, VIII, and IX

- Provides the capability to calculate stock objectives and reorder points for Class I, II, III, IV, VIII, and IX

- Provides the capability to process and track full and partial issues by quantity, date, recipient, and destination for the following classes of supply: Class I, II, III, IV, VII, VIII, and IX.

- Provides the capability to process and track cancellations and partial cancellations

- Provides the capability to prepare issue instructions in electronic or paper format, as required

- Provides the capability to provide on-demand status update of items showing location, owner, and condition

- Provides the capability to track demand history by NIIN, quantity, requestor, location, and cost

- Provides for the capability to provide visibility of material by location after receipt by using units, while on location in a layette until the part is actually applied to an end item

- Provides the capability to process requisitions against the nearest source of supply

- Provide the capability to fence assets in a prescribed manner where applicable

- Provides supply managers visibility of discrepancies or imbalances in records

- Provides the capability to maintain historical records on issues/shipments for a minimum of twenty-seven months

- Provides the means to aggregate demand quantities accurately by weapons system

- Provides approved algorithms for forecasting

- Provides the capability to calculate stockage requirements based on demand usage, estimated usage, or by unifying requirements for a given weapons system

- Provides the capability to establish temporary loan accounts

- Provides the capability to respond to the segregation or assimilation of units into flexible MAGTF structures

- Provides the capability to designate a priority of support sequence for supported units

- Provides the capability to generate standardized storage labels for warehouse locations

- Provides the means of verifying unit configurations, equipment allowances, and accuracy of technical data

- Provides the means to easily conduct technical research by facilitating electronic transfer

- Provides the capability to track items placed in short or long term storage, to include inspection schedules and storage termination dates

- Provide the capability to identify and track split shipments and/or multi-pack shipments

- Provide the capability to accept multiple storage locations for the same type item

- Provides the capability to automatically initiate record changes such as unit of issue, NIIN, and nomenclature

- Provides for the automatic confirmation of deliveries

- Provides for the capability to track items from source to destination

- Provides for the capability to identify "frustrated cargo", or cargo that cannot be positively identified regarding destination

- Provides for the capability to monitor allowances established by higher authority

- By incorporating AIT, the system provides the capability to notify managers of material due for delivery to customers after appropriate supply processing

- Provides the user with an integrated view to manage "Unit Material"

- Provides the capability to track and manage material by expiration date and lot number

- Provides the capability to support the tracking and management of Secondary Reparables

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APPENDIX C. FUTURE FUNCTIONAL CAPABILITIES OF
ATLASS II+ (AFTER REF. 12)

GENERAL

- Provide the capability support touch screen technology and perform "drag and drop" functions

- Provide inter-connectivity with supporting reference databases

- Provide the means to capture requirements via Electronic Data Interchange (EDI)

- Provide the capability to interface with external systems that provide support, such as transportation systems and wholesale supply systems

- Provide the capability to incorporate AIT to scan bar codes to identify serial number, NIIN, owning unit organization, and outstanding repair order number and to update location

- Provide the capability to capture input from a variety of Test, Measurement, and Diagnostic Equipment (TMDE)

- Provide the means to enter (or capture through an external interface such as MDSS II) information on notional items and organizations for exercise purposes

- Provide the capability to track container contents through AIT

MAINTENANCE

- Provide the capability to differentiate between actual hands-on repair time and idle time

- Provides the capability for the user to prepare disposition documentation when an item is declared non-repairable

- Provide the calibration facility the tools to manage calibration requirements so that calibration workload is spread uniformly

- Provide the capability to automate data collection and processing required to generate repair orders

- Provide the capability to facilitate equipment inspection by automating technical references and having this information available in real-time to the technician

- Provide the calibration facility the means of adjusting to changing supported force structures

- Provide the calibration facility the means of tracking calibration requirements for affected items held by the organizational structure the facility supports

- Provide the capability to identify maintenance cycle time by calculating MTBF, MTTR, by type of equipment, across multiple organizations, or within one organization

- Provide for incorporating algorithms that permit adjusting calibration schedules for individual items based on calibration history

- Provide the means for "out patient" repair order generation and parts use capture

- Provide the means to evaluation of supply and maintenance performance

- Provide the managers with the capability to develop evaluation scenarios to assess the impact on maintenance activity, and readiness when existing maintenance conditions change

- Provide the capability to store repair history of individual items to include information on parts required, MTBF, MTTR, and cost of repairs

- Provide tools and algorithms for assessing maintenance productivity

- Provide a decision support capability to assist in making better use of available resources (budget, personnel, facilities, etc.) when readiness figures fall below specified parameters

SUPPLY

- Provide the capability to incorporate supply functions being performed by parallel AISs, e.g., Ammunition Logistics System (AMMOLOGS), Medical Logistics System (MEDLOGS), and Direct Support Stock Control (DSSC) functions

- Provide the capability to extract fiscal authority data from fiscal information systems

- Provide the means for users to alter the conditions for data edit checks and to edit look up tables used for referential integrity

- Provide the means for customer feedback in order to improve performance

- Incorporate AIT as a management tool for PEBs

- Provide the means for individual accounting (both inventory and fiscal) of portions of multiple unit packs used by maintenance

- Provide the capability to incorporate algorithms for prorating miscellaneous shop materials to customer bills

- Provide access to customer fiscal data for billing purposes (fee for service)

- Provide a capability to support both garrison and field mess operations

- Provide a capability to manage unit pack items regarding expiration dates and stock rotations

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- Provide a capability to track status of Initial Issue Provisioning (IIP) packages

- Provide the capability to electronically record individual use of Class I through meal signature cards

- Provide the capability to assist the transportation component by performing aspects of the distribution process that are unique to the supply function

- Incorporate algorithms to forecast Class I, and Class III (Bulk) requirements

- Provide the means for customer input into push requirements determination

- Provide the capability to track receipts, storage, and issue of Class I, and Class III (Bulk)

- Incorporate algorithms for state of the art inventory management

- Provide the capability to determine training allowances, given a specific organizational structure and employment scenario

- Provide condition (status) pertaining to requirements, shipments, and inventories, to customers with no more than an eight-hour delay

- Provide a capability to determine "push" package requirements by unit (recipient), composition, quantities, cost, and date required

- Provide a capability to determine stock rotations, and shelf life

- Provide a capability to facilitate contract generation and establishment

- Provide the capability to "cross-level" assets across the entire Marine Corps, under management control

- Provide capability to access customer stock levels in computing push requirements

- Provide the capability to track items that have special care in storage requirements such as Class I, V, and VIII

- Provide the capability to capture packaging and freight data and make it available to the distribution component (future development) to facilitate load planning

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APPENDIX D. FUNCTIONAL CAPABILITIES OF OPTIMIZED NALCOMIS OMA (AFTER REFERENCES 18 AND 19)

GENERAL

- Provides the capability for global networking via the WAN

- Provides for point of entry data validation

- Provides for pre-filled data fields

- Provides for minimal manual data input (plain language instead of code) of work orders

- Provides for automatic update of data throughout the system as the work order is changed

- Provides for ease of use drag and drop features for transferring components, assemblies, and attached subassemblies between Optimized NALCOMIS OMA organizations

- Utilizes Windows NT and Sybase Central operating systems

FLIGHT SUBSYSTEM

- Provides for the capability to collect and process flight data

- Provides the capability to schedule aircraft, aircrew, and crew activity

- Provides capability to electronically initiate, update, or query flight document records

- Provides capability to electronically approve aircrew or flight documents

- Provides the capability to display real-time readiness of aircraft

- Provides the capability to manage training and proficiency data of aircrew assigned to a specific flight event

- Provides capability to schedule a Watch Bill

- Provides the capability to compute astronomical data

- Provides the capability to assign sub-groups or detachments within an organization

- Provides capability to modify schedules in advance for non-available aircrews

- Provides capability to view or print a detailed schedule which reflects the detailed flight schedule complete with astronomical data, Watch Bill, notes and signatures for the daily, weekly, or monthly schedule

- Provides the capability to document all aspects of a flight to include, aircraft, aircrew, flight hours, flight legs, mission profiles, and weapons loads

- Provides the capability to view or print Aircraft Master Records (AMR) for all aircraft within an organization

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- Provides capability to view flight activity history of an aircrew based on selected aircraft type equipment code (TEC)
- Provides capability to generate flight related reports for aircraft, simulator or both

CONFIGURATION MANAGEMENT SUBSYSTEM

- Provides the capability for the program manager to create, load, and maintain baseline management data on all end items or components
- Provides the capability to automatically track all repairable records defined in the baseline
- Provides the capability to accurately list all components installed or uninstalled on the aircraft
- Provides the capability to forecast scheduled maintenance
- Engine configuration is provided when electronic records are transferred between Optimized NALCOMIS sites
- Provides automated aviation life support system (ALSS) and support equipment (SE) baseline data
- Provides the capability to electronically record logbook records, parachute records, seat survival kit (SSK) records, and aircrew systems records for aircraft mounted components
- Provides capability to track warranted items
- Provides capability to operate in stand-alone mode for indefinite periods. Updates automatically when connection is reestablished
- Provides capability to track service period for a selected aircraft
- Provides capability to list all assembly codes of all naval aircraft and equipment belonging to the U.S. Navy
- Provides the capability to view electronic catalogues to view parts numbers

MATERIAL CONTROL SUBSYSTEM

- Provides near real-time capability to track components on order against an activity's aircraft or other end items
- Provides the capability for material control personnel to assign a document date and serial number (DDSN) to a work order, and to transmit to the IMA
- Provides the capability to cross reference supply data
- Provides the capability to automatically generate pre-expended bin (PEB) and pack-up inventory lists

MAINTENANCE SUBSYTEM

- Provides the capability to track tools

- Provides the capability to track maintenance personnel accountability

- Provides the capability to electronically update or query work orders

- Provides the capability to document all scheduled and unscheduled maintenance against aircraft and other end items

- Provides the capability to view all work orders by status against each aircraft in the organization

- Provides capability for system to automatically update entries from actions on the work order by maintenance personnel

- Provides capability to list all or specific work orders for a selected aircraft, or display the work orders list by status for all aircraft

- Provides a "Remarks" capability in order to concisely describe general description of aircraft.

- Provides a cannibalization capability in order to track and record the issue of cannibalized parts.

- Provides the capability to generate maintenance reports including, aircraft daily status, aircraft material status, Subsystem Capability and Impact Reporting (SCIR), work-center workload, aircraft equipment workload, and inspection reports.

- Provides a maintenance history report capability to reflect all work orders (active, historical) that can be retrieved.

- Provides capability to display and automatically update current status of all support equipment assigned to the organization.

- Provides capability to display and automatically update current status of all aviation life support systems (ALSS) items.

- Provides capability to display and automatically update current status of all aviation life support systems MME items.

- Provides the capability to identify and order replacements for items that failed due to damage or defect from normal wear/use, or when an item's operational limits have been reached.

- Provides the capability to electronically approve work orders.

- Provides capability to initiate pre-formatted work orders for recurring, unscheduled, unscheduled inspections, near due inspections/component removal, fix phase, one time inspection, duplicate and contingency.

- Provides capability at the integrated data environment (IDE) level to forward technical directive (TD) compliance requirements to each inventory item's reporting custodian in order to effect changes.

PERSONNEL SUBSYSTEM

- Provide capability to electronically manage work center personnel

- Provides the capability to view and update crew data, and time and landing history for aircrew personnel

- Provides capability to manage special maintenance qualifications (SMQ) of maintenance personnel

REPORTS – AD HOC QUERY

- Provides a capability to create customized reports

APPENDIX E. FUTURE OPTIMIZED NALCOMIS OMA CAPABILITIES (AFTER REFERENCES 18 AND 19)

PLATFORM SOFTWARE INTERFACE SUBSYSTEM

- Provides a capability to transfer information from "smart" aircraft directly into NALCOMIS OMA

- Provides a capability to load structure fatigue information from aircraft directly into NALCOMIS OMA

- Provides a capability to load strain gauge data from aircraft directly into NALCOMIS OMA

- Provides capability to load Engine Monitoring System (EMS) data from aircraft directly into NALCOMIS OMA

- Provides a capability to load flight control system information from aircraft directly into NALCOMIS OMA

- Provides a capability to load flight control system information from aircraft directly into NALCOMIS OMA

- Provides a capability to load aircraft position data directly from aircraft directly into NALCOMIS OMA

- Provides a capability to load avionics system data from aircraft directly into NALCOMIS OMA

- Provides a capability to load fault codes from aircraft directly into NALCOMIS OMA

- Provides a capability to load component life/cycle data from aircraft directly into NALCOMIS OMA

- Provides a pilot/maintainer debriefing capability with fully integrated IETMs, an engine/aircraft diagnostics/prognostics capability, and a support of Personnel Electronic Display Device (PEDD) and Automated Identification Technologies (AIT)

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